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REPUBLIC OF SOUTH AFRICA

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Certificate
PATENT OFFICE

REPUBLIEK VAN SUID-AFRIKA

DEPARTMENT OF TRADE
AND INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

the documents annexed hereto are true copies of:

Application forms P.1 and P. 2 , provisional specification and drawings of South African Patent Application No. 2001/5469 as originally filed in the Republic of South Africa on 3 July 2001 and post-dated to 3 January 2002 in the name of NXCO INTERNATIONAL LIMITED for an invention entitled: " ACTIVATED STEMMING DEVICE".

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED
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RULE 17.1(a) or (b)

Geteken te PRETORIA in die Republiek van Suid-Afrika, hierdie 15th dag van May 2003
Signed at PRETORIA in the Republic of South Africa, this 15th day of May 2003

Registrateur van Patente
Registrar of Patents

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FORM P2
M R & F Ref: P.19163/Case 13

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978

Post-dated
REGISTRAR OF PATENTS

Official Application No.		Lodging date: Provisional		Acceptance date:	
21 01	20015469	22	~~3 JULY 2001~~ 3.7.2002	47	
International classification		Lodging date: Complete		Granted date:	
51		23			

Full name(s) of applicant(s)/Patentee(s)

71 NXCO INTERNATIONAL LIMITED

Applicant(s) substituted:		Date Registered:
71		

Assignee(s):		Date Registered:
71		

Full name(s) of inventor(s)

72 To be advised

Priority claimed	Country		Number		Date	
Note:	33	NONE	31	NONE	32	NONE
Use International	33		31		32	
Abbreviation for Country	33		31		32	

Title of Invention:

54 ACTIVATED STEMMING DEVICE

Address of applicant(s)/patentee(s)

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Patent of Addition No.	Date of any change:	
1		
Fresh Application based on:	Date of any change:	

McCALLUM, RADEMEYER & FREIMOND
Ref: P19163/Case 13

FORM P1

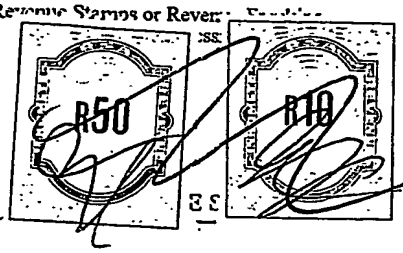
REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT

(Section 30(1) - Regulation 22)

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

Revenue Stamps or Revenue Franking



OFFICIAL APPLICATION NO.

21	01	20015469

FULL NAME(S) OF APPLICANT(S)

71	NXCO INTERNATIONAL LIMITED

ADDRESS(ES) OF APPLICANT(S)

Saffrey Square, Suite 205, Bank Lane, Nassau, Bahamas

TITLE OF INVENTION

54	ACTIVATED STEMMING DEVICE

Priority is claimed as set out on the accompanying Form P2.
The earliest priority claimed is :

This application is a patent of addition to Patent Application No.	21	01	
This application is a fresh application in terms of section 37 and based on Application No.	21	01	

THIS APPLICATION IS ACCOMPANIED BY:

X	1	A single copy of a provisional specification of 10 pages	
	2	Two copies of a complete specification of ..... pages	
X	3	2 . sheets of Informal Drawings	
	4	..... sheets of Formal Drawings	
	5	Publication particulars and abstract (Form P8 in duplicate)	
	6	A copy of Figure ..... of drawings (if any) for the abstract	
	7	Assignment of Invention	
	8	Certified priority document(s) Number(s)	
	9	Translation of priority document(s)	
	10	An assignment of priority rights	
	11	A copy of the Form P2 and the specification of SA Patent Application No.	21 01
	12	A declaration and power of attorney on Form P3	
	13	Request for ante-dating on Form P4	
	14	Request for classification on Form P9	
X	15	Form P2 in duplicate	

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Dated this 3rd day of July 2001.

.....
McCALLUM, RADEMEYER & FREIMOND
PATENT AGENTS FOR APPLICANT(S)

REGISTRAR OF THE COURT OF THE COMMISSIONER OF PATENTS
3.1.2002
~~2001 07 03~~ Post-dated

PATENTS OFFICE
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REPUBLIC OF SOUTH AFRICA

McCALLUM, RADEMEYER & FREIMOND
P.19163/Case 13

FORM P6

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) - Regulation 27)

OFFICIAL APPLICATION NO			LODGING DATE Post-dated	
21	01	20015469	22	3.1.2002 ~~3 JULY 2001~~

FULL NAME(S) OF APPLICANT(S)

71	NXCO INTERNATIONAL LIMITED

FULL NAME(S) OF INVENTOR(S)

72	To be advised

TITLE OF INVENTION

54	ACTIVATED STEMMING DEVICE

BACKGROUND OF THE INVENTION

This invention is concerned generally with the breaking of rock and more particularly is concerned with the provision of stemming in order to confine high pressure forces, in a drill hole, which are generated during the rock breaking process, such as a tailored low energy method of breaking rock.

As used herein the word "rock" includes rock, ore, coal, concrete and any similar hard mass, whether above or underground which is difficult to break or fracture. It is to be understood that "rock" is to be interpreted broadly.

A number of techniques have been developed for the breaking of rock using non-explosive means. These include a carbon dioxide gas pressurisation method (referred to as the Cardox method), the use of gas injectors (the Sunburst technique), hydrofracturing and various methods by which cartridges containing energetic substances pressurise the walls or base of a sealed drill hole to produce penetrating cone fractures (known as PCF).

These techniques may be an order of magnitude more efficient than conventional blasting in that they require approximately 1/10 of the energy to break a given amount of rock compared to conventional blasting using high explosives. The lower energy reduces the resulting quantity of fly rock and air blast and to an extent allows the rockbreaking operation to proceed on a continuous basis as opposed to the batch-type situation, which prevails with conventional blasting.

Most non-explosive rockbreaking techniques rely on the generation of high gas pressures to initiate a tensile fracture at the bottom of a relatively short drill hole. If the force which is generated by the high gas pressure can be optimally used then the efficiency with which rock is broken is increased.

It is customary to confine the pressure generated by the combusting propellant by making use of stemming which is placed in a blast hole and which is tamped in position in order to consolidate the stemming. Nonetheless the stemming is capable of moving to a greater or lesser extent under the action of the forces which are generated when the propellant ignites. The extent to which the stemming confines the forces influences the effectiveness of the propellant in breaking rock to a considerable degree.

SUMMARY OF INVENTION

The invention provides, in the first instance, stemming apparatus which includes a member, a propellant charge and an initiator for igniting the propellant charge to drive the member in a predetermined direction.

The member may be shaped and include a tapered leading end or formation on a side which faces in the said predetermined direction.

Preferably the member is conically shaped on the said tapered leading end.

An opposing side of the member, ie. on a side which is remote from the tapered leading end, may be planar or recessed or shaped in any appropriate way.

The member may be constructed so that it is capable of flaring outwardly when moved in a direction which is opposite to the said predetermined direction.

The member may be made from any appropriate material and, for example, may be made from a high density plastics material, a metallic material or the like.

Control means may be provided for controlling the firing of the said initiator. The control means may include an energy source and a timer for applying energy from the energy source to the initiator at a predetermined time.

The invention also provides a method of stemming which includes the steps of placing stemming material in a hole over a cartridge which includes a first propellant charge, positioning at least one member on the stemming, locating a second propellant charge on the member, and igniting the second propellant charge at a predetermined time relatively to the time at which the first propellant charge is initiated.

Depending on requirements a short time interval may exist between the time at which the second propellant charge is ignited and the time at which the first propellant charge is initiated. It is also possible for the first propellant charge

to be initiated substantially at the same time as the second propellant charge is ignited.

The member may be of any appropriate type and for example may be of a kind which has been described in connection with the aforementioned stemming apparatus.

Additional stemming may be placed over the member and the second propellant charge in the hole prior to ignition of the second propellant charge.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described by way of examples with reference to the accompanying drawings in which;

Figure 1 is side view in cross section of stemming apparatus according to one form of the invention being used in a rock breaking process,

Figure 2 is a view similar to Figure 1 but illustrating a different form of the stemming apparatus according to the invention, and

Figure 3 illustrates a control mechanism for use with the stemming apparatus of Figure 1 or Figure 2.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 of the accompanying drawings illustrates the use of stemming apparatus according to one form of the invention during a rock breaking process.

in position. The nature of the stemming and the way in which is tamped are known in the art and for this reason are not further described herein.

A member 34 is then placed over the stemming 32. The member has a conical leading end 36 which faces downwardly into the stemming and, in this example has a substantially planar trailing end 38 which faces upwardly. The maximum diameter of the member 34 is slightly less than the nominal diameter of the hole 10.

A propellant charge 40 is placed on the member or, preferably, is incorporated in the member under factory conditions. An initiator 42 is engaged with the propellant charge. Control leads 44 lead from the initiator to the control unit which is used for firing the initiator 28.

When the initiator 28 is energised the propellant 26 in the cartridge combusts and causes the release of high pressure jet material which is substantially in gaseous form. The cartridge 16 expands outwardly and deforms, without rupturing, to confine the high pressure gas up to a stage at which the cartridge fractures at which point the high pressure jet material is released to cause fracture of the rock at one or more points at which high pressure stress regions are created. At this stage substantial force is exerted on the stemming 32 and as the stemming is radially confined there is a tendency for the stemming to move upwardly and out of the hole.

The invention provides a technique for counteracting the force which tends to drive the stemming out of the hole and which originates from the propellant

26. This is achieved by firing the initiator 42 to initiate the propellant charge 40. When this occurs a force is applied to the trailing side 38 of the member and it is driven downwardly into the stemming 32 thereby producing a force which counteracts the upwardly directed force which is produced by the propellant 26. If the propellant charge 40 is ignited at a precisely determined time relatively to the instant at which the propellant 26 is ignited then the shock waves which are transmitted through the stemming 32 from the propellant material 40 and from the propellant 26 on the other hand can, at least to a substantial extent, be cancelled out. This means that the tendency of the stemming 32 to move out of the hole is restricted and the high pressure jet material which is released by the propellant 26 is confined to a substantial extent. Significantly higher pressures are therefore generated inside the confined volume occupied by the expanding cartridge and, as a consequence, higher forces are generated to fracture the rock in the region of the cartridge.

When the propellant 40 is detonated the member 34 is driven downwardly. In order to enhance the force which is exerted on the member additional stemming 50 may be placed over the member and the propellant material before deflagration takes place. Although there is a tendency for the material 50 to be expelled from the hole 10 the stemming nonetheless provides a restraining force which helps to increase the net force acting on the member 34.

The arrangement shown in Figure 2 is similar in many respects to what is shown in Figure 1 and where applicable like reference numerals are used to designate like components.

In the Figure 2 arrangement the member 34 has a conical leading end 36 but, on a trailing side, has a recessed formation 52. The propellant charge 40 and the initiator 42 are located in the recessed formation. As has been described in connection with Figure 1 stemming 50 is preferably placed over the member 34 and the propellant charge before ignition of the propellant charge takes place.

When the charge is ignited the member 34 is driven downwardly thereby assisting in confining the underlying stemming 32. The member 34 is however shaped so that there is a tendency for the member to expand radially outwardly when the member is driven towards the mouth of the hole. This may occur for example if the force which is released by the propellant 26 in the cartridge is significantly greater than the force which is produced by the propellant charge 40. A similar situation may also arise if the times at which the propellant 26 and the propellant charge 40 are initiated are such that there is no significant cancellation of the oppositely directed forces produced by these materials.

It is apparent from the aforegoing that it is highly desirable to be able to control the time at which the propellant charge is ignited precisely with respect to the time at which the propellant 26 is initiated. This can be achieved in a

variety of ways and Figure 3 illustrates, somewhat schematically, a suitable control technique.

Figure 3 shows a control unit 60 which is connected to the control wires 30 and which is used to generate an electrical signal which is applied to the initiator 28 associated with the cartridge 16. The control wire 44 shown in Figure 1 leads to a component 62 which is associated with the propellant charge 40. The component 62 contains a capacitor 64 which is charged, preferably beforehand, by energy supplied by the control unit 60.

When a suitable further control signal is generated by the control unit 60 a timer 66 in the component 62 is started and after a predetermined time interval, which is programmed beforehand, the capacitor 64 is caused to discharge by closure of a switch 68, included in the timer, which then applies the energy stored in the capacitor to an initiator 42 which causes the propellant charge 40 to be fired.

The initiator 28 may have a similar timing mechanism associated with it. Alternatively the initiator 28 may be directly fired by means of a control signal from the control unit and this control signal may be used to start the timer 66 to ensure that the ignitor 42 is fired a short interval after the initiator 28 is fired. Clearly this technique can be reversed in that the ignitor can be fired directly by means of a control signal from the control unit and the initiator 28 can then be fired a short interval after the propellant charge is ignited. The important aspect here is that it is possible, through the use of suitable control

techniques, to fire the propellant charge 40 and the propellant 26 within predetermined time intervals of each other in order to ensure that the shock wave which is transferred to the stemming 32, by the propellant 26 is effectively counter-balanced by the member 34 which is driven into the stemming by the propellant charge 40.

Dated this 3rd day of July 2001.

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Patent Agents for the Applicant

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FIG 1

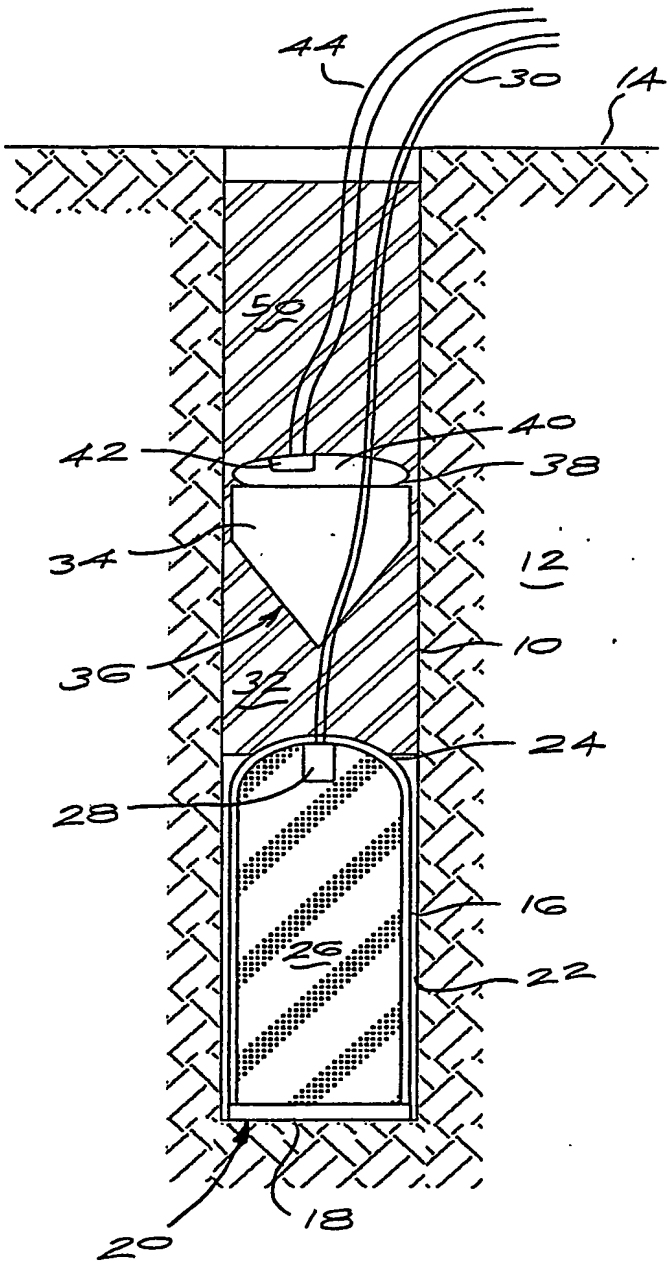
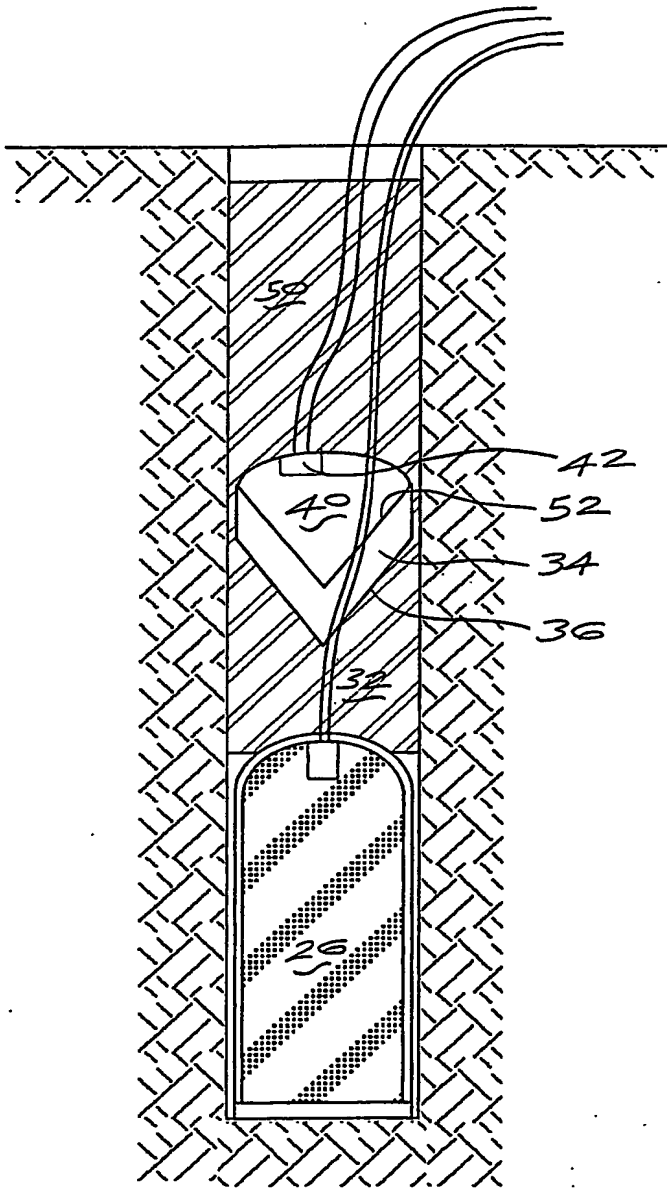


FIG 2



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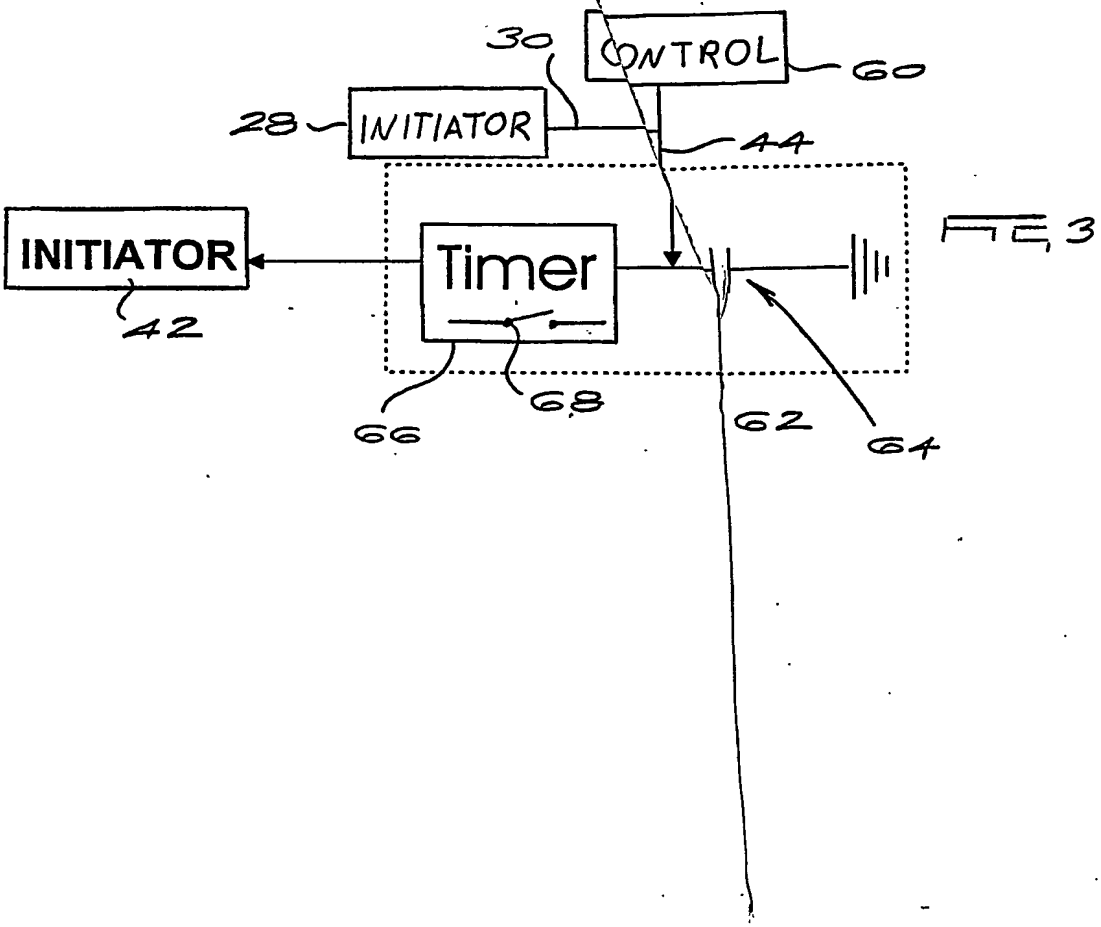

FIG 3

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